Last Name, First Name
Chatsworth Charter High School
Earth and Space Systems
Mr. Minassian H-52
Fall 2013 Period #

On the Front of the Notebook

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Contents

Title: Student Investigation Obscertainers-Black Box

LAB 1

Background:
Scientific Method-Using accurate observations to check a hypothesis

Example:
The atom is so small we cannot directly observe it. We know about the properties of atoms because of INDIRECT measurements and interpretations of experiments with <u>observable</u> results.

Purpose:
Scientists use indirect observations to make hypotheses and draw conclusions about objects that are too small to be seen. In this investigation, you are to determine the shape and configuration of the partition(s) inside a closed container.

Materials:
Lab handout, 2containers

Safety:
Although the materials in this activity are considered nonhazardous, please observe all normal laboratory safety guidelines.

Procedure:
1. Your teacher will pass out the closed containers.
These containers have a marble ball that may roll freely inside, blocked only by partitions within the container.
2. Your job is to determine the shape of the partition(s) in each container without opening them
3. You may move the ball around by carefully tilting and listening to the container.
4. For 10 seconds, using your senses, determine your Hypothesis about the shape and location of the partition(s) inside.
5. Record the number of the container on the blank, and then sketch your hypothesis in the left-hand "Hypothesis" box.
6. For up to a minute, retest your hypothesis and indicate any changes you want to make in the middle "Retest" box. This should be your final decision.
7. Do four containers. Switch containers with other students when so instructed by your teacher. Although some containers are more difficult than others, you should not spend more than 2 minutes with each container.

Data Collection

Container Number	Hypothesis	Retest	Actual

Conclusion/Questions

1. What difficulties did you have doing this investigation?

2. What things were you able to determine through indirect observation?

3. How do you think this investigation relates to work done in Laboratory in a business or research facility?

Title: Golf Ball Bath

LAB 2

Purpose: Understand the steps of the Scientific Method

Prediction/Hypothesis: (answer) what do you think happens to a golf ball that is placed in fresh water compared to being placed in salt water?

Materials: 2 clear cups, 1 Golf Ball, water, salt, Graduated cylinder

Procedure / Data:

1. Fill up the graduated cylinder to the 500ml line.
2. Pour water into 1 clear cup. Stop at the top line.
3. Place a Golf Ball inside the container. What did you observe?
4. Take golf ball out
5. Place 4 spoon full's of salt into the container, mix well.
6. Place a Golf Ball gently in. What did you observe?
7. Take golf ball out.
8. Put 4 more spoon full's of salt into the container.
9. Place the Golf Ball gently in. What did you observe?
10. Take golf ball out.
11. Pour out half of the mixture into the empty cup, you will not need it.
12. Place the golf ball into the half filled cup. What did you observe?
13. Slowly pour water into the container with the golf ball.
    What did you observe?

Dump all solutions into the sink and clean up.

Analysis:

Make a list of facts and known reactions. give (3)

Conclusion

1. **Was your prediction correct? Why or Why not?**
2. **Describe what happen and why it happened, for step 3.**
3. **Describe what happen and why it happened, for step 9.**

Describe what happen and why it happened, for step 13.

LAB 3

Title: Penny Drop Lab

Purpose: Understand the steps of the Scientific Method, Find out the threshold of water droplets that fit on a penny, Lincolns face side

Hypothesis: I think a penny will hold ________________ drops of water.

Materials: Penny, Eyedropper, Water, testing liquid, towels

Procedure:

1. Penny must be dry and on a flat surface.
2. Use the eye dropper to drop water on the penny, one drop at a time.
3. Count the number of drops until the water spills over the edge of the penny.
4. Record your data.
5. Repeat 3 steps 1 -4

Data:

Trial	***Number of Drops***
1	
2	
3	
Ave.	

Conclusion:

Restate the Hypothesis. Explain the errors or differences of the drop values you got. Conclude the lab with a summary.

LAB 4

Title **Using Different Measuring Devices**

Purpose Become familiar with common units of measurement in the metric system and how to convert between them. You will also learn to make careful measurements with three common pieces of lab equipment.

Standards I & E: 1b, 1c, 1d, 1f

Hypothesis We will study three types of units, one for length, mass, volume: m, kg, L

Materials Metric ruler, graduated cylinder, balance, water, paper clips, Irregular Objects (2)

Procedure

Part 1: Measuring Length

a. Using your metric ruler, measure the length of the chain paper clips in centimeters. Remember to estimate the value between the lines on the ruler. Record your results in the data table.
b. Use your knowledge of the metric conversions to convert the measurement in centimeters (cm) to millimeters (mm), decimeters (dm), and kilometers (km). Record your results in the data table.
c. Repeat Steps 1, 2 but with the irregular objects

Part 2: Measuring Mass

a. Using the balance, measure the mass of the chain of paper clips in grams. Remember to estimate the value between the lines on the scale. Record your results in the data table.
b. Use your knowledge of metric conversions to convert the measurement in grams (g) to milligrams (mg), centigrams (cg), decigrams (dg), and kilograms (kg). Record your results in the data table.
c. Repeat Steps 1, 2 but with the irregular objects.

Part 3: Measuring Volume

a. Fill the graduated cylinder with water to 20.0 mL.
b. Fold the chain of paper clips in such a way that they are able fit completely into the water. Measure the volume and record your results in the data table. Remember to estimate the value between the lines on the cylinder.
c. Subtract your results from 20.0 mL to obtain the actual volume of the chain of paper clips. Record your results in the data table.
d. Use your knowledge of metric conversions to convert the measurement in milliliters (mL) to centiliters (cL), deciliters (dL), liters (L), and kiloliters (kL).
e. Repeat Steps 1-4 but with the irregular objects.

Data/Analysis

Table 1: Measuring Length

	Millimeters (mm)	Centimeters (cm)	Decimeters (dm)	Meters (m)	Kilometers (km)
Paper Clips					
Irregular Object 1					
Irregular Object 2					

Table 2: Measuring Mass

	Milligrams (mg)	Centigrams (cg)	Decigrams (dg)	Grams (m)	Kilograms (kg)
Paper Clips					
Irregular Object 1					
Irregular Object 2					

Table 3: Volume Difference

	Initial Volume (mL)	Final Volume (mL)	Difference (mL)
Paper Clips			
Irregular Object 1			
Irregular Object 2			

Table 4: Measuring Volume

	Milliliters (mL)	Centiliters (cL)	Deciliters (dL)	Liters (L)	Kiloliters (kL)
Paper Clips					
Irregular Object 1					
Irregular Object 2					

Conclusion

In your own words, what is the purpose/objective lab activity? How does this lab activity teach you important skills in the laboratory? Explain why the metric system is used in the scientific community. Explain the importance of the estimating the last number in your measurement with each device.

Title p.612 **Inquiry activity-CH 22- How do impact craters form?**

Purpose Understand the relationship between the heights an object is dropped to the size of the crater formed. Explain the connection between crater size and object size.

LAB
5

Hypothesis

Materials Protractor, meter stick (2) box of sand, golf ball, tennis ball

Procedures

a) Fill a large container with sand to a depth of ~5cm. Flatten surface of the sand with a ruler.
b) One at a time, drop each of the different sized balls from heights of 0.5 m, 1m, 2m into the container. Make sure to smooth out the sand between each drop.
c) Measure the diameter and height of the crater produced each time.

Data

	0.5 m	1.0 m	2.0 m
Golf Ball			
Tennis Ball			

Conclusion

Think about it

1. **Making Graphs**
   Identify your dependent and independent variables. Then plot your data on a line graph.

2. **Controlling Variables**
   Which of the variables is directly related to the velocity of the falling objects?

3. **Drawing conclusions**
   Examine your data closely. What can you conclude about the general relationships between crater size and the size, mass, and velocity of the object that produced the crater?

Title **<u>Interpreting Quantitative Data</u>**

LAB 6

Purpose/Objective In this activity you will examine selected graphs/data tables representing quantitative data, make appropriate observations and interpret your findings.

Standards I & E: 1b, 1c, 1d, 1j, 1k

Hypothesis (write a response to the purpose)

Materials Various graphs and data tables

Procedure

1. For each graph or table, perform the following
   A. Write the title
   B. List type of Data whether the section represents a data table, line graph, bar graph or pie chart.
   C. Identify manipulated (independent) / responding (dependent) variables.
   D. Make one or more significant observations for each case in which comparisons are being made of if the data is changing. Describe the trend that you observe.
   E. Write an interpretation for each observation as best you can even though you will have very little background information to add support to your observations.

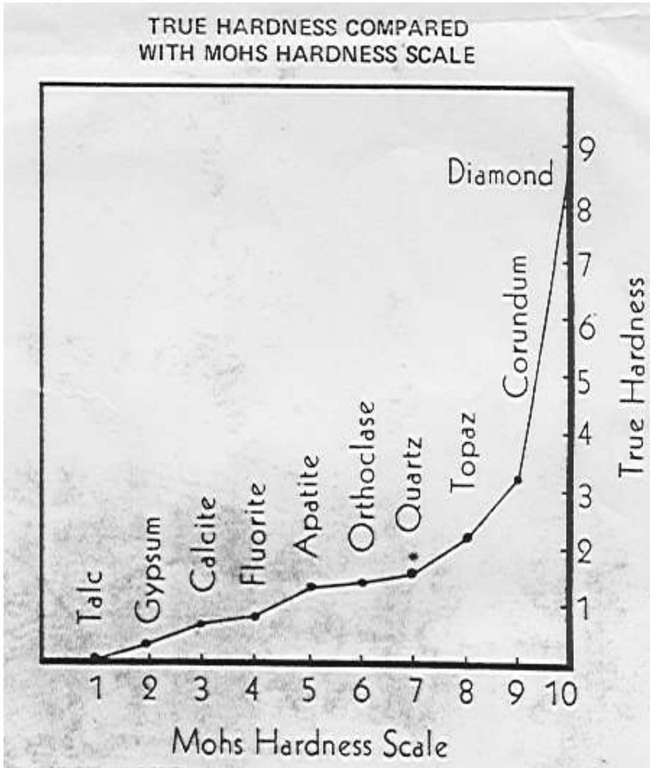
Data/Analysis

List the tasks completed for each graph/table.

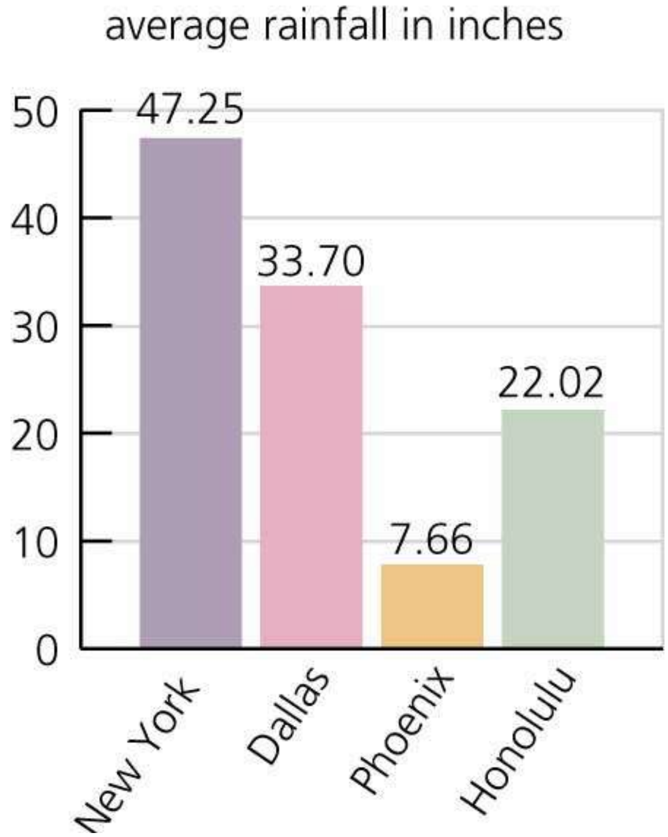
Conclusion

What is the objective of the lab activity?
What did you learn about the objectives?
In your own words, what do manipulated and responding variables mean?
Why is it so difficult to make interpretations for the graphs and data tables given?

#1

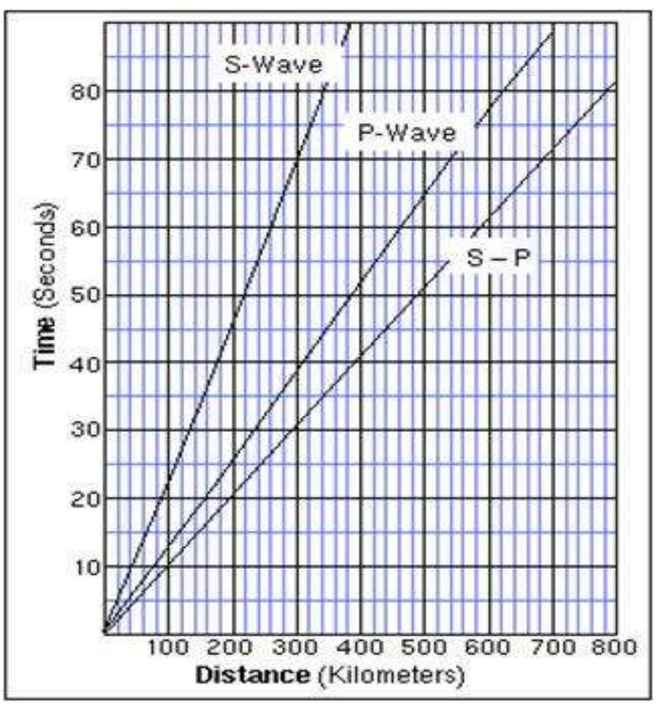


#2



#3

P-Wave and S-Wave Travel Time Curve

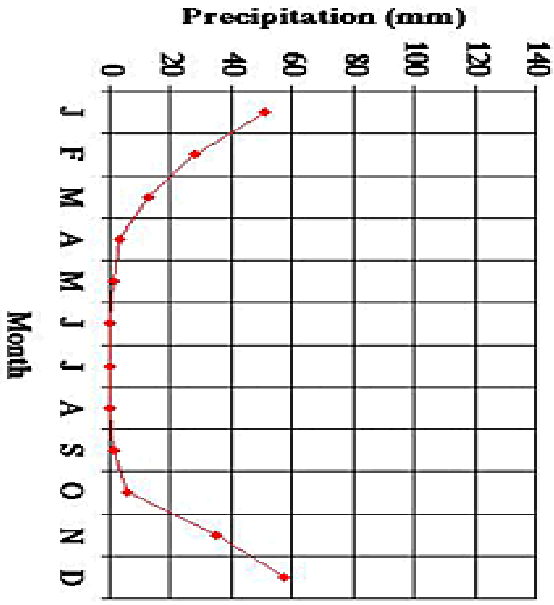


#4

Mean Earnings, Full-Time, Year-Round Workers, by Age, Educational Attainment and Sex: 2003

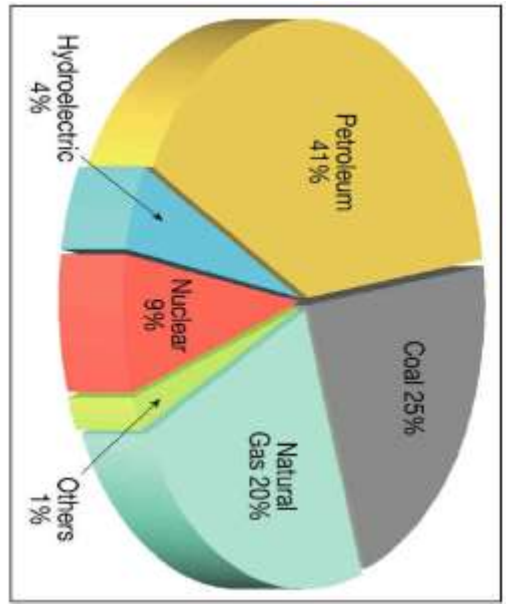
	Male	Female	Female: % of Male
Total	$53,039	$37,197	70.1%
by Age			
18 to 24 years	23,785	20,812	87.5
25 to 34 years	41,993	35,845	85.4
35 to 44 years	56,515	39,234	69.4
45 to 54 years	61,291	40,335	65.8
55 to 64 years	65,765	39,448	60.0
65 years and over	58,398	30,927	53.0
by Level of Education			
Less than 9th Grade	23,972	20,979	87.5
9th to 12th Grade	29,100	21,426	73.6
High School Graduate	38,331	27,956	72.9
Some College, No Degree	46,332	31,655	68.3
Associate Degree	48,683	36,528	75.0
Bachelor's Degree	69,913	47,910	68.5
Master's Degree	85,628	57,635	67.3
Professional Degre	148,331	84,091	56.7
Doctorate Degree	105,648	84,588	80.1

#5 Rainfall Graph: Egyptian Desert



#6

Energy Sources



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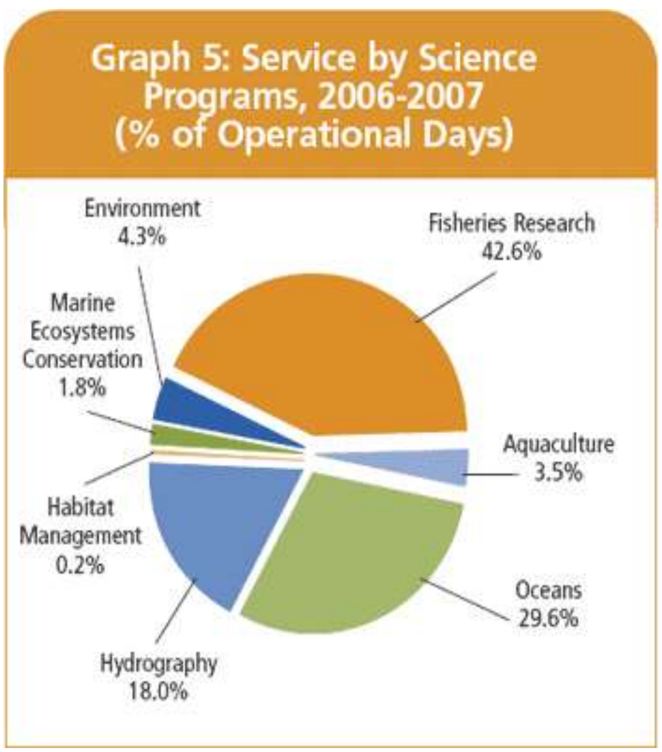

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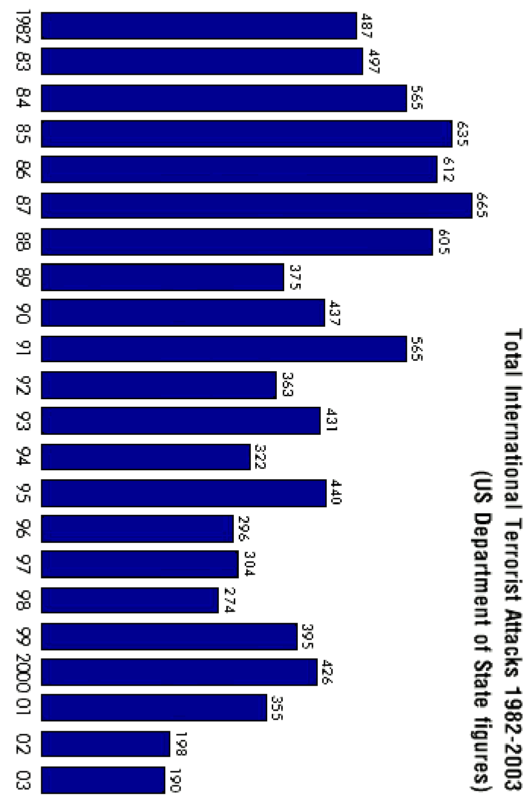


LAB 7

Title: Silly Putty

Purpose: To understand how solutes and solvents interact in a solution.

Materials: Glue, Borax, water, spoon

Procedures:

1. Mix 3 teaspoons of borax and 15 ml of water
2. Mix a quarter cup of glue and 20 ml of water
3. Make sure the mixture with borax is saturated
4. Then mix the two together: pour the borax mixture into the glue mixture

Questions

1. How does mixing separately help?

2. How would Hot water help?

3. 3 sentences: What did you learn about?
    a. Solution
    b. Solute
    c. Solvent

Conclusion

LAB 8

Title **Extended Activity: Moon Phases**

Purpose/Objective Students will examine the moon and learn about the different phases that occur in a lunar cycle.

Standards ES 1, 3

Hypothesis

Materials camera

Procedure

1. Take a picture of the moon every night for the next four weeks.
2. The day or days after you take the picture, you will organize the pictures in you lab book
3. Label the date time and type of moon each day

Data/Analysis

Sun	Mon	Tue	Wed	Thu	Fri	Sat
Example day →	Date 9/02/15 Time 10:04pm Waxing Gibbous 					

Conclusion

In your own words, what is the purpose/objective for this activity? What did you learn about the moon and its phases? What conditions made it difficult for you to take a picture of the moon? How can you improve in your ability to make astronomical observations, whether it is the moon or other celestial objects?

Title **<u>pg. 673 Inquiry Activity-CH 24- How does the Position of the Setting Sun Change?</u>**

Purpose The connection between movement of Earth around its axis, the sun, and the tilt of Earth all play a role in the observation of the Suns position on the Horizon changes.

LAB 9

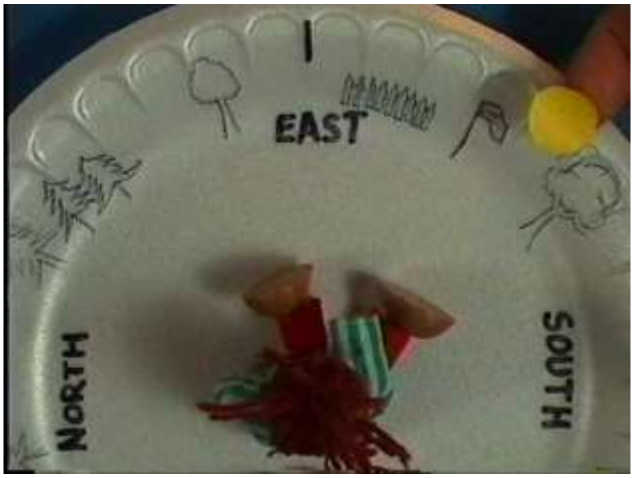
Standard ES 1e, g, 2d I& E 1j

Hypothesis

Procedure

a) Several minutes before sunset, estimate where the sun will set on the western horizon, Draw prominent features, such as buildings and trees, to the north and south of the Sun's setting position
b) As the Sun sets, draw its position relative to the fixed features on the horizon. Caution, never look directly at the sun; eye damage may result.
c) Note the date and time of your observation.
d) Return to the same position several days later. Repeat the activity and record the results. Wait several more days then do the activity one more time.

Data



Example is like this picture, but you don't need to make it on a plate just on your paper.

Have Directions of NSEW, Have where you are located and have the Suns location

Conclusion

Think about it

1. **Observing**
   How did the sun's position at sunset change over the course of your observations?

2. **Predicting**
   Based on your observations, predict where the sun might set in several weeks' time. Sketch the sun on your drawing relative to the fixed features of the Horizon.

Title **pg. 699 Inquiry Activity-CH 25 - How Do Astronomers Measure Distances to Nearby Stars?**

Purpose Understand how the distance an object is from us the more or less parallax

LAB
10

Standard ES 1d, 2a-g

Hypothesis

Procedures

a) Close your left eyes, with your index finger in a vertical position, use your right eye to line up your finger with a distant object, such as a tree. Or indoors a clock or part of the wall…

b) Without moving your finger, view the object with your left eye open and your right eye closed.

Data

What happen?

Conclusion

Think about it

1. **Observing**
   What happened to the position of your fingers when your observed it with your left eye?

2. **Predicting**

What might happen if you repeated the activity, holding your finger farther from your eyes? Test the Hypothesis.

Title **Hertzsprung - Russell diagram**

Purpose/Objective In this activity you will make your own Hertzsprung-Russell diagram and see how star brightness, color, temperature, and spectral class are related.

Standards E.S. 2a, 2b, 2c

LAB 11

Hypothesis The relationship between a star's brightness, color and temperature is …

Materials Colored pencils

Procedure

1. Study chart below. Note the sun, used as a standard brightness, by the value of 1. The brightness given for each other star shows how that star compares with the sun.
2. Plot the data from both charts on the graph paper provided.
3. Stars with surface temperatures up to 3500˚C are red. Shade a vertical band from 2000˚C to 3500˚C a light red.
4. Shade other color bands as follows: Stars from 3500 to 5000˚C are orange, from 5000 to 6000˚C are yellow, from 6000 to 7500˚C are white, and 7500 to 40000˚C are blue.
5. Look for patterns in your graph.
6. Label the main sequence, the red supergiants, and the white dwarfs.

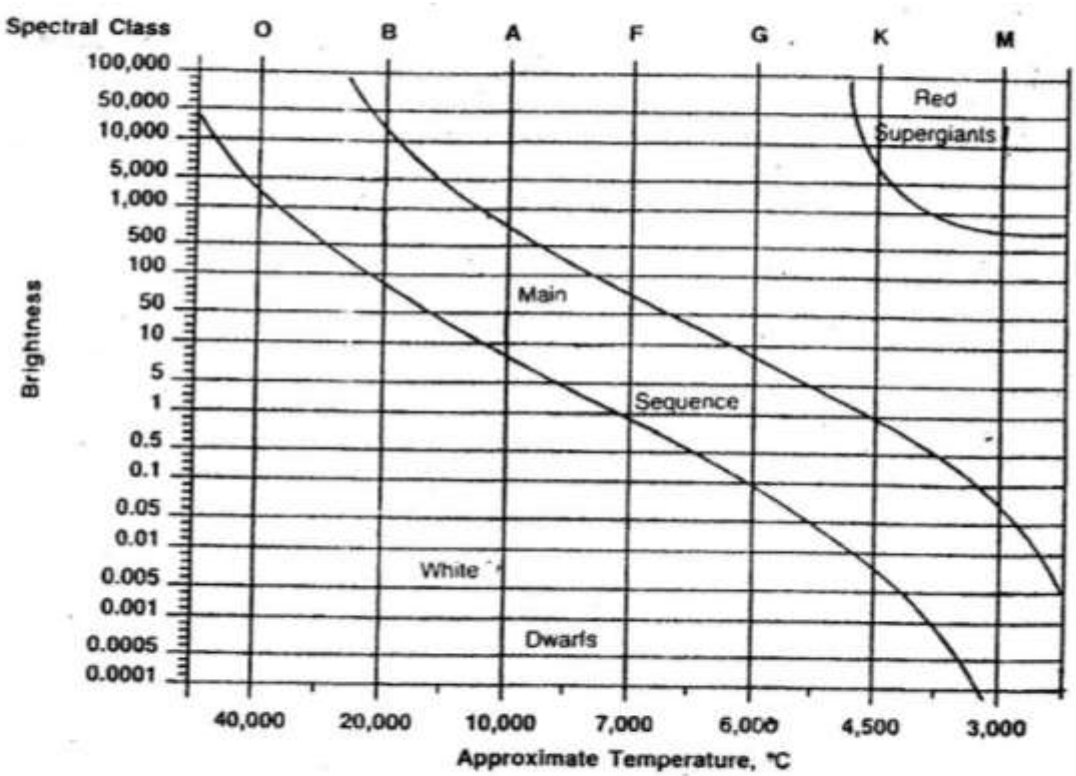
Star Name	**Approximate Temperature, ˚C**	**Brightness (Sun = 1)**
Sun	5300	1
Alpha Centauri A	5500	1.3
Alpha Centauri B	3900	0.36
Barnard's Star	2500	0.0004
Lalande 21185	2900	0.005
Sirius A	10100	23
Sirius B	10400	0.008
Ross 248	2400	0.0001
61 Cygni A	3900	0.08
61 Cygni B	3600	0.04
Procyon A	6200	7.6
Procyon B	7100	0.0005
Epsilon Indi	3900	0.13
Canopus	7100	1500
Arcturus	4200	90
Vega	10400	60
Capella	5600	150
Rigel	11500	40000
Betelgeuse	2900	17000
Achernar	14000	200
Beta Centauri	21000	3300
Altair	7700	10
Aldebaran	3900	90
Spica	21000	1900
Antares	3100	4400
Deneb	9900	40000
Beta Crucis	22000	6000

Data/Analysis

See other sheet.

Conclusion

In your own words, what is the purpose/objective for this activity? What did you learn about the purpose/objective? What was your hypothesis? How close was it to the actual data given from the graph? Explain. What differences did you observe between your hypothesis and the data?



1. What is the general relationship between temperature and star brightness? ____________

____

2. What relationship do you see between star color and star temperature? ____________

____

3. How does the sun compare to the other stars on the main sequence? ____________

____

4. What star class does our sun belong to? ____________

5. A star is classified as being in class B. What is its color? Temperature? ____________

____

____

6. We know dwarfs are small—smaller than our sun. How can they be so bright? ______

____

Title <u>**Introduction to Spectroscopy**</u>

Purpose/Objective Your goal here is to learn how to use a spectroscope to make observations of white light as well as specific gaseous elements. You will draw the spectra for all your observations.

LAB 12

Standards E.S. 1e, 1g, 2d

Hypothesis

Materials Spectroscope, Spectrum tube power supply, color pencils

Procedure

1. Use the spectroscope to view the spectrum of white light. Draw exactly what you see in figure 1.
2. Using the spectroscope again, you will observe the spectra of various elements found in stars. Draw them as you see them in figure 2.

Data/Analysis

Figure 1. Visible Spectrum for white light

Wavelength – Short Medium Long

Energy -- High Medium Low

Figure 2. Bright line spectra for 3 selected gaseous elements

Hydrogen

Helium

Unknown

Analysis Questions

1. Refer to figure 1, which color of light has the highest energy? Lowest energy?
2. Explain what is causing us to see colored lines in the spectra of the elements.
3. Why is the spectrum of an element like a fingerprint?
4. Based on the reference chart, identify your unknown.

Conclusion

In your own words, what is the purpose/objective for this activity? What did you learn about the purpose/objective? How can you use the spectrum of a star to identify the elements contained in it? Since the sun's spectrum doesn't appear to have single lines like specific elements, rather it has a continuous spectrum, what does it tell you about the elements contained within the sun?

Title: Star Spectra

Purpose Students will observe the spectra of several young stars to determine the elements they contain and their relative ages.

LAB
13

Standards E.S. 1e, 1g, 2a, 2b, 2c

Hypothesis Describe what you think happens to the number of elements contained in a star as it ages.

Materials Scissors, Spectrogram

Procedure

1. Carefully cut along the dotted lines of the spectrogram handout.
2. Insert the pullout tab into the slots of the spectroscope as follows: Down A, Up B, Down C, Up D, Down E, and out.
3. Your instructor will show you how to read the spectra for star A. Record your observations in the table.
4. Use the same technique to read the spectra for the five other stars

Data

Star	Elements Present
A	
B	
C	
D	
E	
F	

Analysis

1. What two elements do you normally find in younger stars?
2. Which stars from the table are probably the youngest? Explain.
3. How do the number of elements and type of elements change in stars as they get older?
4. Which stars from the table are probably the oldest? Explain.

Conclusion

What is the purpose/objective for this lab activity? How do your results prove or disprove your hypothesis? Since all of these are examples of young stars, how does the number of different elements change as the star ages? Why do you think stars contain elements other than just Hydrogen? What happens to the other elements when the Hydrogen fuel runs out?

Title Studying the Sun

LAB 14

Purpose Students will study the features and characteristics of the Sun based on observations.

Standards E.S. 1e, 1g, 2d

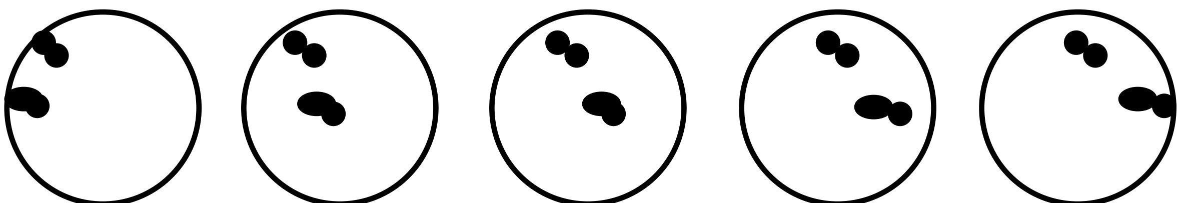
Hypothesis

Materials Graph paper

Procedure

1. Sketch the five pictures that show the Sun with its sunspots at different dates.
2. Copy the data tables.
3. Graph the data from the tables using a graph paper.

Data/Analysis



Year	Number of Spots	Year	Number of Spots
1890	7	1922	14
1892	72	1924	16
1894	78	1926	64
1896	41	1928	78
1898	26	1930	36
1900	9	1932	11
1902	5	1934	9
1904	42	1936	80
1906	53	1938	110
1908	48	1940	68
1910	18	1942	31
1912	3	1944	101
1914	9	1946	93
1916	57	1948	136
1918	80	1950	84
1920	37	1952	32

Analysis

1. Do the pictures suggest that the Sun rotates like the Earth? Explain.
2. Notice that the sunspots near the north pole travel slower than the ones near the equator. What does this suggest about the composition of the Sun? Explain.
3. Describe the patterns and trends that you observe in sunspot activity.
4. Magnetic storms occur in the Earth's upper atmosphere about every 10-12 years. Do you see a relationship between these storms and the sunspot cycle? Explain.

Conclusion

What was the purpose/objective of this lab activity? What evidence do we have that shows that the Sun rotates? How does this evidence show that the Sun is not a solid? What gas or gases are used as the fuel for the Sun's energy? What is the relationship between sunspot cycles and magnetic storms in our atmosphere?

Crystal Growth- Supersaturated Solution: Rock Candy Lab

LAB 15

Purpose To introduce crystal growth in order to demonstrate the properties of supersaturated solutions

Hypothesis

Background Solubility of substances improves with stirring (mechanical energy) and by heating (heat energy). You will find that the solvent dissolves only so much solute. After a while, the excess solute precipitates to the bottom. When this happens, the liquid is a saturated solution. Solutes dissolve in larger quantities when placed into heated liquids (solvents) because the molecules of the heated liquids vibrate further apart. The spaces between the molecules become greater and more solid molecules (sugar) can fill these spaces. As the liquid cools down, the spaces between the molecules become smaller and the excess solids precipitate to the bottom. Heating solvents to dissolve additional solute. Once the solution cools, it now has more solute than it normally could have, and this is called a supersaturated solution. Once a solution becomes supersaturated, it wants to crystallize the excess solute. The solute will form crystals on any surface. In our case the surface is a string, and we are using a lifesaver candy as our "seed." A seed is a starting point; a solid piece of sugar candy will mimic a sugar crystal, and start the chain reaction of crystallization. If the jar is left uncovered, crystals may even form on the dust that settles on top.

Materials 250 mL beaker, scale, sugar, water, a clean jar, string, stirring rod, and candy

Procedure
1. Using the 250 mL beaker, measure 150 mL of water.
2. Measure out 450 g of Sugar using a plastic cup and spoon.
3. Adding 1 spoonful of sugar at a time, dissolve as much sugar as possible in the water. (you may add food coloring at this time if desired)
4. Once you have a saturated solution, place the beaker on a hotplate and allow the water to get hot, but do not bring to a boil
5. While waiting for the water, prepare a string by measuring approximately 15 cm and tying one to a Lifesaver.
6. Once the solution is hot, allow your instructor to bring it to your lab desk. Add one spoonful at a time of sugar until no more sugar can be dissolved. If the solution cools too much, reheat it on the hotplate.
7. Stir to help dissolve the sugar. When no more sugar dissolves and some remains in the bottom of the beaker, the solution is supersaturated - even if you do not see any solute in the bottom.
8. Tie the other end of the string to a popsicle stick so that the string hangs down into the jar and does not touch the bottom.
9. Pour the cooled solution into the jar. 10.Cover the jar with a piece of foil to keep the dirt out. Avoid bumping the liquid. As the liquid sits, the excess sugar molecules will come out of solution and climb the string.

Discussion
1. What is the difference between an unsaturated, saturated and a supersaturated solution?
2. What was the solute in the lab? The solvent?
3. Why is it necessary to heat a solvent in order to make a supersaturated solution?
4. Describe a point in the lab where each of the following happened…
    a. had an unsaturated solution
    b. had a saturated solution
    c. had a supersaturated solution
5. Why was it necessary to use a "seed candy"?
6. Sugar dissolves easily in water. Since "like dissolves like", what does sugar's solubility in water tell you about the properties of sugar molecules?
7. Besides increasing the temperature of the water, describe two ways you could get sugar to dissolve in water faster.
8. Talk with your group, and try to come up with one other method to create a supersaturated solution that does not involve heating. (How can you remove more solvent?)
9. You dissolved 450.0 g of sugar ($C_{12}H_{22}O_{11}$) in 150 mL of water. The density of water is 1.00 g/mL
    a. calculate the molarity of the solution
    b. calculate the molality of the solution

Conclusion
A: Describe how you created a supersaturated solution and how you formed sugar crystals.

B: Describe The general shape of the crystals (Were they round? jagged? smooth? etc), and how does it compare to the sugar you started with. How successful were you at creating rock candy? Did you make a lot, a little?

C: Describe any problems you had with the crystals. Did any crystals form on places other than the string? Was any stuck to the jar? Explain how you think these problems could be avoided. If you had the perfect crystal, then explain why you think yours turned out so much better and explain how you think you can make even larger crystals.